

Comparative histological investigation of silver nanocomposites on the natural and synthetic matrix

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Introduction. Composite materials containing silver nanoparticles have unique properties and are promising for medicine. The aim of our investigation was to make a comparative assessment of the histological alterations of silver nanoparticles encapsulated in a natural (arabinogalactan) and synthetic (poly-1-vinyl-1,2,4-triazole) polymer matrix.

Materials and methods. One hundred forty-four 144 three-month-old white outbred male rats were used for the investigation. The animals were randomly assigned to six groups ($n = 24$): two groups were exposed to silver nanoparticles encapsulated in natural biopolymer arabinogalactan (group nAG) and synthetic poly-1-vinyl-1,2,4-triazole (group nPVT) at a dose $500 \mu\text{g}/\text{kg}$. Two groups received an aqueous solution of polymers without nanoparticles (groups AG and PVT) in an equivalent volume. Animals of CS group received an aqueous dispersion of colloidal silver, stabilized by casein, with a silver content of 8%. Animals of control group received distilled water. Solutions were administered orally using an atraumatic probe for 9 days. The investigation was carried out in 2 stages: 12 rats from each group were withdrawn from the experiment immediately after exposure (early period), 12 rats — 6 months after the end of exposure (long-term period). Preparation of samples of nervous tissue was carried out according to the standard method [1].

Results and Discussion. In the nAG group, disturbances in the structure of the nervous tissue were revealed by expansion of the perivascular spaces, swelling of vascular bundles, neuronophagy, swelling of myocytes and vascular endotheliocy. These disorders were also noted in the long-term period. Morphological examination of brain tissue preparations from exposed nPVT rats showed only insignificant swelling of the conductive fibers of the animals in the early period of investigation. In the PVT group only, single changes were observed that did not have multiple confirmations and did not differ from the control. In rats treated with CS, the results of the morphological examination of brain preparations were comparable with the results of the control group. In animals of the AG group, at all examination periods, a slight expansion of the perivascular spaces and neuronophagy was revealed, which indicates metabolic changes in the structure of cells and tissues. Thus, pathological abnormalities expressed in the structure of the temporoparietal zone of the sensorimotor cortex of the rat brain, increasing over time, were found in the nanobiocomposite of silver nanoparticles and the natural polysaccharide arabinogalactan.

References

- 1) Korzhevsky, D.E. A Summary of the Basics of Histological Techniques for Physicians and Laboratory Assistants-Histologists; Kroph: Saint Petersburg, Russia, 2008; 48p.